

CLAIMS

Sub B7 1. An antenna device for transmitting and/or receiving electromagnetic radiation, installable in and connectable to a communication device, and comprising;

5 - an antenna structure switchable between a plurality of antenna configuration states, each of said plurality of antenna configuration states being distinguished by a set of radiation parameters; and

10 - a switching device for selectively switching said antenna structure between said plurality of antenna configuration states, wherein

- each of said plurality of antenna configuration states is adapted for use of the antenna device in the communication device in a respective predefined physical operation environment.

2. The antenna device as claimed in claim 1, wherein each predefined physical operation environment is defined by objects affecting the electromagnetic radiation and located within a distance from said communication device of less than ten wavelengths of the electromagnetic radiation.

Sub B7 3. The antenna device as claimed in claim 1, wherein said communication device is a wireless hand-portable radio communication device.

4. The antenna device as claimed in claim 1, wherein one of said plurality of antenna configuration states is adapted for use of the antenna device in the communication device in a talk position.

5. The antenna device as claimed in claim 1, wherein one of said plurality of antenna configuration states is adapted for use of

the antenna device in the communication device in a free space environment.

6. The antenna device as claimed in claim 1, wherein one of said plurality of antenna configuration states is adapted for use of the antenna device in the communication device in a waist position.

7. The antenna device as claimed in claim 1, wherein one of said plurality of antenna configuration states is adapted for use of the antenna device in the communication device in a pocket position.

8. The antenna device as claimed in claim 1, wherein a control device is arranged to receive an indicator which indicates a change from a first to a second of said predefined physical operation environments and which controls said switching device to switch said antenna structure from a first to a second of said plurality of antenna configuration states, in accordance with said indicator.

9. The antenna device as claimed in claim 8, wherein said indicator represents a reflection coefficient of the communication device.

10. The antenna device as claimed in claim 8, wherein said indicator represents an operation state of the communication device.

11. The antenna device as claimed in claim 1, wherein the control device receives a measure of a detected physical property of an operation environment, said operation environment being external to said antenna device and to the communication device having the antenna device installed therein, and controls said switching device, and hence the selective switching of said antenna

structure between said plurality of antenna configuration states,
in accordance with said measure.

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12. The antenna device as claimed in claim 11, wherein the measure
of the detected physical property of the operation environment is
5 received from a sensor.

13. The antenna device as claimed in claim 12, wherein the measure
of the detected physical property of the operation environment is
received from at least one of a resistive, capacitive, inductive,
optic, temperature, pressure, inclination, orientation, and motion
10 sensor.

14. The antenna device as claimed in claim 11, wherein the control
device receives a second measure of a second detected physical
property of the operation environment, and controls said switching
device, and hence the selective switching of said antenna
15 structure between said plurality of antenna configuration states,
in accordance with said second measure.

15. The antenna device as claimed in claim 14, wherein the
detected physical properties are derived from different spatial
portions of the operation environment.

20 16. The antenna device as claimed in claim 15, wherein the
detected physical properties are of different nature.

17. The antenna device as claimed in claim 1, wherein the
plurality of antenna configuration states include different
numbers of connected antenna elements.

25 18. The antenna device as claimed in claim 1, wherein the
plurality of antenna configuration states include differently
arranged RF feed connections.

19. The antenna device as claimed in claim 1, wherein the plurality of antenna configuration states include differently arranged RF ground connections.

5 20. The antenna device as claimed in claim 1, wherein said switching device includes a microelectromechanical system (MEMS) switch device.

10 21. The antenna device as claimed in claim 1, wherein said antenna structure includes a switchable antenna element having at least one of meander, loop, slot, patch, whip, helical, spiral and fractal configurations.

15 22. The antenna device as claimed in claim 1, wherein said antenna structure comprises a transmitting antenna structure and a receiving antenna structure, and said plurality of antenna configuration states comprise a plurality of antenna configuration states for the transmitting antenna structure and a plurality of antenna configuration states for the receiving antenna structure, each antenna structure being switchable independently of each other between its respective plurality of antenna configuration states.

20 23. A radio communication device comprising an antenna device according to claim 1.

25 24. A method for transmitting and/or receiving RF radiation in antenna device including a switchable antenna structure installable in and connectable to a communication device, the method comprising:

30 - adapting each of a plurality of antenna configuration states, each antenna configuration state being distinguished by a set of radiation parameters, in the switchable antenna structure for use of the antenna device in the communication device in a respective predefined physical operation environment

- selectively switching the switchable antenna structure between said plurality of antenna configuration states.

25. The method as claimed in claim 24, wherein each of said predefined physical operation environment is defined by objects
5 affecting RF radiation and located within a distance from the communication device of less than ten wavelengths of RF waves.

26. The method as claimed in claim 24, wherein said selectively switching is performed from one to another of said plurality of antenna configuration states, said one and another antenna
10 configuration states being adapted for use of the antenna device in said radio communication device in any two of the following said predefined physical operation environments: a talk position, a free space environment, a waist position, and a pocket position.

27. The method as claimed in claim 24, further comprising controlling said selectively switching with a measure indicating a change from a first to a second of said predefined physical operation environments is received and said switching device to switch said antenna structure from a first to a second of said
15 plurality of antenna configuration states, in accordance with said measure.

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28. The method as claimed in claim 24, further comprising controlling said selectively switching with a measure of a detected physical property of an operation environment, the
25 environment being external to the antenna device and to the communication device having the antenna device installed therein, to switch said antenna structure between the plurality of antenna configuration states, in accordance with the measure.

29. An antenna device for transmitting and receiving radio frequency waves, installable in a radio communication device, and
30 comprising;

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- an antenna structure switchable between a plurality of antenna configuration states, each antenna configuration state being distinguished by a set of radiation parameters;

- a switching device which selectively switches said antenna structure between said plurality of antenna configuration states; and

- a control device which receives a detected physical property of an operation environment, said operation environment being external to the antenna device and to the communication device having the antenna device installed therein, and which controls said switching device, and the selective switching of said antenna structure between said plurality of antenna configuration states, in accordance with said detected physical property.

30. The antenna device as claimed in claim 29, wherein a measure of the detected physical property of the operation environment is received from at least one of a sensor, particularly a resistive, capacitive, inductive, optic, temperature, pressure, inclination, orientation, and motion sensor.

31. The antenna device as claimed in claim 29, wherein the control device receives a measure of a second detected physical property of the operation environment, and controls said switching device, and hence the selective switching of said antenna structure between said plurality of antenna configuration states, in dependence on said second measure.

32. The antenna device as claimed in claim 31, wherein the detected physical properties are derived from different spatial portions of the operation environment.

33. In an antenna device installable in a communication device, and comprising

- an antenna structure switchable between a plurality of antenna configuration states, each of which is distinguished by a set of radiation parameters; and

- a switching device which selectively switches said antenna structure between said plurality of antenna configuration states,

a method for transmitting and receiving radio frequency waves comprising the steps of:

- receiving a detected physical property of an operation environment, the operation environment being external to the antenna device and to the communication device having the antenna device installed therein; and

- controlling said switching device, and the selective switching of the antenna structure between the plurality of antenna configuration states, in dependence on the detected physical property.

34. The method as claimed in claim 33, wherein the measure of the detected physical property of the operation environment is received from a sensor.

35. The antenna device as claimed in claim 1, wherein said set of radiation parameters includes at least one of resonance frequency, impedance, radiation pattern, polarization and bandwidth.

36. The method as claimed in claim 24, wherein said set of radiation parameters includes at least one of resonance frequency, impedance, radiation pattern, polarization and bandwidth.

37. The antenna device as claimed in claim 29, wherein said set of radiation parameters includes at least one of resonance frequency, impedance, radiation pattern, polarization and bandwidth.

38. The method as claimed in claim 33, wherein said set of radiation parameters includes at least one of resonance frequency, impedance, radiation pattern, polarization and bandwidth.

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